Memorandum

To: *Kareem Adeem, Acting Director,*
Department of Water & Sewer Utilities, City of Newark

From: *Sandy Kutzing, P.E., CDM Smith*

Date: *August 25, 2019*

Subject: Sampling Protocol for Point of Use (POU) Filter Testing – Multiple Filters

A protocol was provided on August 5, 2019 for filter sampling at three (3) homes in the City of Newark (City). Based on the protocol review and the results, it was determined that a larger sampling pool is needed with more representative samples passing through the point of use (POU) filters based on actual usage to access exposure and efficacy of the filters.

The goal of the original protocol dated August 5, 2019 was to challenge the filters and consider the worst-case scenario at three (3) homes, i.e. samples from the lead service line after 6+ hours of stagnation time. There were two (2) rounds of sampling conducted, one round for all three homes conducted on July 8-10, 2019 and a second round for two (2) of the three (3) homes conducted on August 6, 2019. Not all of the filters met the expected lead reduction in the samples taken from the stagnated water in the lead service line. However, the faucet filters did operate as expected for the first draw and flushed samples with filtered lead levels at 2 ppb or lower. The pitcher filter tested did not reduce lead levels as expected for the filtered first draw and flushed samples in addition to the stagnated sample from the lead service lines.

The goal of this protocol is to obtain samples from more homes with filters in the Pequannock system with varying periods of stagnation to better represent varying water usage by residents and differing lead sources and lead levels in the City. Samples in the lead service line are targeted to compare with the results of the worst-case scenario samples that were previously analyzed. First draw samples on premise plumbing for homes both with and without lead service lines will also be targeted. Both filtered and unfiltered samples will be taken, however, the testing does not represent before and after filtration as each sample volume represents a different section of plumbing.

Selecting Samples

Based on the site audit data for several homes in the City, it appears that the 7th liter typically represents the water in a service line in single family homes. Therefore, the 7th liter was used for sampling purposes when testing for water in the service line. For a multi-family house, a house with a copper service line at the meter, or a house with extensive interior plumbing, the sample location

may be adjusted in the field as needed and will be noted in the field notes. In addition to the service line samples, first draw samples and flushed samples will be taken for analysis at each home.

The sample sites that tested above 50 ppb in recent LCR Compliance Sampling will be targeted for both homes with lead service lines and homes without lead service lines. In addition, door-to-door sampling will be conducted to obtain a large pool of samples. The field team will attempt to verify whether or not there is a lead service line at the meter when on-site to perform the sampling. This will be noted in the field notes.

Filters with green and yellow indicator lights will be tested and recorded in the field notes. Several filters with red indicator lights will also be tested and recorded. If the indicator light is red, the sampler will replace the filter cartridge, explain how to condition the new filter to the resident and stress the importance of replacing the filter cartridge on a regular basis. The sampler will attempt to schedule a return visit later that day or the following day to test the new filter.

Single family homes will be targeted, however, multi-family homes (maximum 3 family) will also be sampled especially if on the list of sites that saw lead levels above 50 ppb in compliance sampling. Many single family homes have been converted to two or three-family homes in Newark and these will be sampled, preferably on the first floor.

The following samples will be taken at each home visited:

1. **Pequannock, lead service line** (based on sampling category from sampling pool, verified on-site, or high confidence based on materials database)
    a. First draw sample – filtered 500 mL sample, then unfiltered 500 mL sample
    b. 7th liter (or adjust based on estimated service line location) – filtered 500 mL sample, then unfiltered 500 mL sample (adjust location of sample based on approximate lead service line location, i.e. significant indoor plumbing or faucet not on first floor)
    c. 5 minute flush – unfiltered 500 mL sample, then filtered 500 mL sample
2. **Pequannock, no lead service line** (based on sampling category from sampling pool, verified on-site, or high confidence based on materials database)
    a. First draw sample – filtered 500 mL sample, then unfiltered 500 mL sample
    b. 7th liter (or adjust based on estimated service line location) – filtered 500 mL sample, then unfiltered 500 mL sample
    c. 5 minute flush – unfiltered 500 mL sample, then filtered 500 mL sample

Preparing the Samples

Samples will be taken from the kitchen sink in increments of 500 mL. Aerators, both on filter units and on taps without filters, are to remain, and should be unaltered, while sampling and only cold water is to be sampled. The sampler shall collect the information listed in the Field Notes sheet included in Attachment No. 1. It is important to determine when the water was last used in the home and also at the kitchen faucet specifically. The sampler will also ask questions on how the filter is typically operated.

Each sample is provided a unique ID. Water sample location along the service line (i.e. first draw, service line and which liter it was taken at, flushed) is to be included in the field notes.

Bottles shall be labeled prior to collecting the samples with waterproof labels and a "Sharpie" pen. The samples are to be taken at the kitchen faucet continuously by running the cold water tap at a flowrate that would typically be used by the residents to fill a glass of water. It is critical to open the faucet gently, keep the flow continuous and at a constant flowrate to avoid disrupting insoluble lead particles on the pipe walls.

The samples should be chilled in a cooler with ice and brought to 239 Central Avenue at the end of each day. The samples will be acidified by the samplers and packed for delivery to the laboratory. Once the sample is preserved, it does not need to be chilled with ice. A chain of custody form shall be completed for each sampling location and placed into a plastic bag inside the cooler along with any additional paperwork required by the individual laboratories. The chain of custody forms must be checked with the labels both at the sampling site and again when packed for the laboratory. The samples can be held and dropped off at the laboratory the following day, however, this will impact turnaround time and add 1 day to the analysis. An example chain of custody is included in Attachment No. 2.

Conducting the Sampling

The specific procedures for sample collection of the faucet filters and pitcher filters are as follows. All sample bottles shall be certified, pre-cleaned HDPE wide-mouth single-use bottles.

Pequannock, Lead Service Line

Faucet Filter Sampling

1. Place the filter in the "on" position. Start a timer and turn on the faucet.
2. Collect a first draw 500 mL sample in a new bottle with the filter "on" (i.e. first draw, filtered sample).
3. Immediately following the first sample, turn the filter "off" and collect a 500 mL sample in a new bottle with the filter "off" (i.e. second draw, unfiltered sample).
4. Collect and dump 10 x 500 mL samples to drain using "waste" bottles to reach the 13th 500 mL sample in the line, or start of the 7th liter. The first 9 should be unfiltered (filter "off") and

the final 10th waste bottle should be filtered (filter "on"). This location should represent the water in the lead service line for most homes with lead service lines in the Pequannock area. Adjust the location of the sample as needed for houses with very long or short service lines.

5. One (1) 500 mL sample shall be collected with the filter in the "on" position in a new 500 mL bottle (i.e. service line, filtered sample).

6. The filter shall be switched to the "off" position and one (1) 500 mL sample shall be collected in a new 500 mL bottle (i.e. service line, unfiltered samples).

7. Continue running the faucet with the filter in the "off" position until 5 minutes is reached on the timer. The unfiltered flowrate can be taken during this time by recording the time to fill a 500 mL bottle.

8. When 5 minutes is reached on the timer, collect a flushed, unfiltered sample (i.e. 5 minute flushed, unfiltered sample).

9. Turn the filter to the "on" position and run the water for 10 seconds. Collect a flushed sample (i.e. 5 minute flushed, filtered sample).

10. Measure the flowrate with the filter "on" by recording the time to fill a 500 mL bottle.

11. The following parameters shall be tested by a certified laboratory for each sample:

    - 500 mL bottles: total lead

Pitcher Filter Sampling

1. Start a timer and turn on the faucet.

2. Collect a first draw 500 mL sample in a new bottle (i.e. first draw, filtered sample).

3. Collect a second 500 mL sample immediately after the first sample in a new bottle (i.e. second draw, unfiltered sample).

4. Collect and dump 10 x 500 mL samples to drain using "waste" bottles to reach the 13th 500 mL sample in the line, or start of the 7th liter. This location should represent the water in the lead service line for most homes with lead service lines in the Pequannock area. Adjust the location of the sample as needed for houses with very long or short service lines.

5. Collect two (2) 500 mL samples consecutively in new 500 mL bottles (i.e. service line samples – filtered and unfiltered),

6. Continue running the faucet until 5 minutes is reached on the timer. The flowrate can be taken during this time by recording the time to fill a 500 mL bottle.

7. When 5 minutes is reached on the timer, collect two flushed sample (i.e. 5 minute flushed samples – filtered and unfiltered).

8. If the pitcher has a new filter cartridge that has not yet been used to filter water, run water through the filter by filling the top portion 3 times with flushed water from the faucet after all of the sampling is complete. If the filter has been used to filter water for the resident, this step is not required.

9. Shake the first 500 mL sample and pour it into the filter pitcher and filter the entire sample. Pour the filtered water into a new 500 mL bottle and discard the first bottle.

10. The second sample should not be filtered through the pitcher as it represented unfiltered water.

11. The third sample (i.e. filtered service line) should follow the same protocol as the first sample (step #9).

12. The fourth (i.e. unfiltered service line) and fifth (i.e. unfiltered flushed) samples do not get filtered.

13. The sixth sample (i.e. filtered flushed sample) should follow the sample protocol as the first sample (step #9)

14. The following parameters shall be tested by a certified laboratory for each sample:

    - 500 mL bottles: total lead

Guidance on Different Field Scenarios

The following provides some guidance on handling various field scenarios:

1. Resident does not have a PUR filter provided by the City or any other filter.

    a. Provide the resident with a filter. If the sampler does not have a filter, report this address to the City for a filter to be delivered.

    b. Offer to come back to test the filter once it's been conditioned.

2. Resident has a PUR filter but also uses another type of filter – typically a refrigerator door filter that they use for drinking water.

    a. If the resident also has a PUR filter, test the PUR filter per the protocol in this document.

    b. After the flushed filtered/unfiltered samples are collected from the PUR filter, collect a flushed sample from the fridge filter.

c. Collect the information from the fridge filter and record it in the field notes.

3. Resident does not have a PUR filter but has another type of filter.

    a. Test the filter per the protocol in this document.

    b. If it is a refrigerator door filter, Take a first draw from the refrigerator door filter. Second sample should be unfiltered second draw sample. No other samples should be taken.

4. Multiple residents in the same building request sampling.

    a. Test only from the lowest floor that the sampler has access to.

5. Filter indicator light is red.

    a. Assist the resident in changing out the filter cartridge with a new cartridge and explain the conditioning procedures.

    b. Schedule a return visit to test the new filter.

6. Resident has a new filter that has not been used yet.

    a. Schedule a return visit once the filter has been used for at least 1 day.

7. Resident is currently using water.

    a. Schedule a return visit to a time when the water will not be in use.

8. Low flow through filter.

    a. If it takes more than 1 minute to fill a 500 mL bottle, stop sampling and replace the filter with a new cartridge. Assist the resident with conditioning the filter and schedule a return visit.

Further Studies

Results will be provided on a rolling basis as they are analyzed. This testing protocol will be modified and/or expanded as needed based on the results.

Total lead (soluble and particulate lead combined) will be analyzed with the collected samples under this testing protocol. Soluble lead and particulate lead particles will be analyzed under a separate study involving ultrafiltration at the three (3) original test locations in the Pequannock area and additional homes if possible.

Attachments:

Attachment No. 1 – Field Notes
Attachment No. 2 – Chain-of-Custody Example

Attachment No. 1

City of Newark Filter Testing Field Notes

Address:_____

Account No.: _____

Sample	Filtered / Unfiltered	Volume (Total Lead)	Time since turned faucet on (0 for 1st draw)	Approx cumulative volume (at start of sample)	Notes
		(mL)	(seconds)	(mL)	
1	Filtered	500		0	Start timer before turning on faucet.
2	Unfiltered	500		500	
3	Filtered	500		6000	With 2 waste bottles, collect and dump 10 bottles (9 unfiltered, 1 filtered). Collect 13th sample in a new bottle for a filtered sample in the LSL. (Adjust if a very long or short service line)
4	Unfiltered	500		6500	Turn off filter. Immediately collect the 14th bottle in a new bottle for an unfiltered sample in the LSL.
5	Unfiltered	500		5 minutes from start	Run water unfiltered until 5 minutes from start of testing. Sample unfiltered at 5 minutes.
6	Filtered	500		5 minutes from start (approx)	Turn on filter, flush for 10 seconds and then sample filtered.

DATE AND TIME OF SAMPLE DATE _____ TIME _____

SAMPLES COLLECTED BY: _____ SIGNATURE: _____

HOMEOWNER/TENANT QUESTIONS

NAME? TENANT/HOMEOWNER? _____

TIME SINCE MOST RECENT WATER USAGE AT KITCHEN FAUCET: HOURS: _____ (STAGNATION)

TIME SINCE MOST RECENT WATER USAGE IN HOUSE: _____ (STAGNATION)

ANY MAJOR USES OF WATER TODAY AND WHEN? (i.e. showers, laundry, dishes, etc.) _____

FREQUENCY OF USE OF FILTER? WHAT IS IT USED FOR? _____

COLD AND/OR HOT WATER USE THROUGH FILTER? _____

WHEN WAS FILTER CARTRIDGE LAST REPLACED (APPROX)? _____

HAVE THEIR BEEN ANY RECENT PLUMBING CHANGES? _____

HAS THEIR BEEN ANY RECENT CONSTRUCTION IN YOUR AREA? _____

RESIDENCE TYPE (BASED ON OBSERVATION)? _____

SAMPLER ITEMS TO COMPLETE

SERVICE LINE MATERIAL: _____

PLUMBING MATERIAL (I.E. COPPER, PEX, ETC.): _____

APPROX LENGTH FROM MAIN TO HOUSE (NOTE EXTENSIVE INTERIOR PLUMBING): _____

FAUCET LOCATION AND FLOOR: _____

SECONDS TO FILL 500 ML BOTTLE (UNFILTERED) (secs): _____

SECONDS TO FILL 500 ML BOTTLE (FILTERED) (secs): _____

FILTER TYPE - FAUCET OR PITCHER _____

FILTER AND CARTRIDGE BRAND AND MODEL NO.: _____

LIGHT INDICATOR ON FILTER (GREEN, YELLOW, RED) _____

SAMPLER TO CONFIRM FILTER INSTALLED PROPERLY. VISUAL CHECK BEFORE SAMPLING AND OPEN FILTER HOUSING AFTER SAMPLING. CONFIRM CATRIDGE INSTALLED PROPERLY. _____

COMMENTS/NOTES: _____

Attachment No. 2

CHAIN OF CUSTODY FORM
CDM Smith
Filter Testing

SAMPLING LOCATION	CLIENT INFORMATION	LABORATORY INFORMATION	
SEQUENTIAL SAMPLING ADDRESS:	CLIENT: Sandra Kutzing, CDM Smith kutzingSL@cdmsmith.com	NAME:	DATE OF DROP OFF:
Account No.:	ADDRESS: 110 Fieldcrest Ave, #8, 6th Floor Edison, NJ 08837	ADDRESS:	TURNAROUND TIME:

MEDIA TYPE	PRESERVATIVES	SAMPLE TYPE	ANALYSIS	BILLING INFORMATION
1. Surface Water	1. HCL, pH <2	G = Grab	Total Lead	
2. Groundwater	2. HNO3, pH <2	C = Composite		
3. Leachate	3. NaOH, pH >12			
4. Field QC	4. H2SO4, pH <2			
5. Soil/Sediment	5. Zinc Acetate, pH >9			
6. Oil	6. Ice Only			
7. Waste	7. Not Preserved			
8. Other Drinking Water	8. Other			

Sample No.	Sample ID		Media Type	Sample Type	Preserve	Volume (mL)	Date Sampled	Time Sampled	Analysis - Total Lead	Comments
1		-FILTERED-FD-1	DW	G	2	500			x	
2		-UNFILTERED-FD-2	DW	G	2	500			x	
3		-FILTERED-SL-3	DW	G	2	500			x	
4		-UNFILTERED-SL-4	DW	G	2	500			x	
5		-UNFILTERED-FLUSH-5	DW	G	2	500			x	
6		-FILTERED-FLUSH-6	DW	G	2	500			x	
			DW	G	2	500			x	
			DW	G	2	500			x	
			DW	G	2	500			x	
			DW	G	2	500			x	
			DW	G	2	500			x	
			DW	G	2	500			x	
			DW	G	2	500			x	
			DW	G	2	500			x	
			DW	G	2	500			x	

SAMPLER SIGNATURE:	RELINQUISHED BY:	DATE/TIME:	RECEIVED BY:	DATE/TIME: